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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/833,515	04/12/2001	Sarah F. Frisken		2552

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Patent Department
Mitsubishi Electric Research Laboratories, Inc.
201 Broadway
Cambridge, MA 02139

EXAMINER

FERRIS III, FRED O

ART UNIT PAPER NUMBER

2128

DATE MAILED: 10/27/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/833,515

Applicant(s)

FRISKEN ET AL.

Examiner

Fred Ferris

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 April 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 April 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>4/12/2001</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. *Claims 1-18 have been presented for examination based on applicant's disclosure filed on 12 April 2001. Claims 1-18 have been rejected by the examiner.*

Information Disclosure Statement

2. *The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered. For example, page 1, paragraph 2 of the specification references "Collision detection between geometric models: a survey", Lin et al, Proc. IMA Conference on Mathematics of Surfaces, 1998, and "A survey of deformable modeling in computer graphics", Gibson et al, MERL Technical Report, TR97-19, 1997, that has not been included in applicant's PTO-1492 IDS form.*

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

3. ***Claims 1-18 are rejected under 35 U.S.C. 101 because the claimed invention is drawn to non-statutory subject matter.***

Specifically, claims 1-18 are simply drawn to the manipulation of abstract ideas (i.e. modeling interactions between models). The Examiner submits that Applicant's have not recited any limitations relating to a practical application in the technological arts and have merely claimed a manipulation of abstract ideas realized as mathematical constructs. Section 2106 [R-2] (Patentable Subject Matter — Computer-Related Inventions) of the MPEP recites the following:

"In practical terms, claims define nonstatutory processes if they:
– *consist solely of mathematical operations without some claimed practical application (i.e., executing a "mathematical algorithm"); or*
– ***simply manipulate abstract ideas**, e.g., a bid (Schrader, 22 F.3d at 293-94, 30 USPQ2d at 1458-59) or a bubble hierarchy (Warmerdam, 33 F.3d at 1360, 31 USPQ2d at 1759), **without some claimed practical application.**"*

An invention which is eligible for patenting under 35 U.S.C. § 101 is in the "useful arts" when it is a machine, manufacture, process or composition of matter, which produces a concrete, tangible, and useful result. The fundamental test for patent eligibility is thus to determine whether the claimed invention produces a **"useful, concrete and tangible result."** The test for practical application as applied by the examiner involves the determination of the following factors:

(1) "Useful" - The Supreme Court in *Diamond v. Diehr* requires that the examiner look at the claimed invention as a whole and compare any asserted utility with the claimed invention to determine whether the asserted utility is accomplished.

(2) "Tangible" - Applying *In re Warmerdam*, 33 F.3d 1354, 31 USPQ2d 1754 (Fed. Cir. 1994), the examiner will determine whether there is simply a mathematical construct claimed, such as a disembodied data structure and method of making it. If so, the claim involves no more than a manipulation of an abstract idea and therefore, is

nonstatutory under 35 U.S.C. § 101. In Warmerdam the abstract idea of a data structure became capable of producing a useful result when it was fixed in a tangible medium which enabled its functionality to be realized.

(3) "Concrete" - Another consideration is whether the invention produces a "concrete" result. Usually, this question arises when a result cannot be assured. An appropriate rejection under 35 U.S.C. § 101 should be accompanied by a lack of enablement rejection, because the invention cannot operate as intended without undue experimentation.

The Examiner respectfully submits, under current PTO practice, that the claimed invention does not recite either a useful, concrete, or tangible result and is merely drawn to a manipulation of abstract ideas.

- *The invention is not **useful** since the method and apparatus of claims 1-18 does not recite a result that is useful in the technological art. This makes it difficult to determine Applicant's invention since it merely claims a manipulation of abstract ideas by modeling interactions between models having a spatial hierarchy. While the specification for the claimed invention mentions representing graphics objects or physical systems as possible uses, the limitations of the claimed method merely appear to manipulate an abstract idea and do not recite a useful graphic object or physical system result. (The patent eligibility standard requires **significant functionality to be present to satisfy the useful result aspect** of the practical application requirement. See *Arrhythmia*, 958 F.2d at 1057, 22 USPQ2d at 1036.)*
- *The claims are not **tangible** since, for example, the results of the "interaction between the first and second models" are undefined. (see independent claims 1 and 17)*

- The claims are not **concrete** because the results are not assured. For example, is a solution possible for any and all arbitrary inputs? (i.e. any adaptively sampled distance field?)

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

- 4. Claims 1-16 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.**

Specifically, independent claim 1 includes limitations relating to an interaction procedure and properties that have not been sufficiently disclosed in the specification. While page 7, lines 8-17 of the specification mentions that the interaction procedure is an "identity procedure", the specification is completely silent on specifically how this procedure is implemented. No algorithms or techniques are disclosed describing specifically how the interaction procedure (or the identity procedure) is actually realized. Similarly, the specification mentions that the interaction properties include properties "such as force fields", but give no clear and concise description of what the interaction properties actually are or specifically how they are used. Figures 2a and 2b do not cure

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this deficiency. Accordingly, a skilled artisan would not be able to make and/or use the claimed invention without undue experimentation. Dependent claims 2-16 inherit this defect.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

MPEP 2171 requires the following:

2171 Two Separate Requirements for Claims Under 35 U.S.C. 112, Second Paragraph

The second paragraph of 35 U.S.C. 112 is directed to requirements for the claims:

*The specification shall conclude with one or more claims particularly pointing out and **distinctly claiming** the subject matter which the applicant regards as his invention.*

There are two separate requirements set forth in this paragraph:

(A) the claims must set forth the subject matter that applicants regard as their invention; and

*(B) the claims must particularly point out and distinctly define the **metes and bounds** of the subject matter that will be protected by the patent grant.*

*The first requirement is a subjective one because it is dependent on what the applicants for a patent regard as their invention. The second requirement is an objective one because it is not dependent on the views of applicant or any particular individual, but is evaluated in the context of whether the claim is definite — **i.e., whether the scope of the claim is clear to a hypothetical person possessing the ordinary level of skill in the pertinent art.***

*In this case, independent claims 1 and 17 recite a method for **“modeling interactions between a plurality of models”** that is indefinite. The examiner submits that*

it is **unclear** specifically what the invention is modeling and specifically what the claimed interactions between the models are. Further, the language of the independent claims 1 and 17 fails to point out specifically what the modeling includes or excludes in the language of the claims and therefore a skilled artisan would be at odds to determine the exact metes and bounds of the claims. As previously cited above, the specification appears to indicate that the "modeling interactions between models" is directed toward collision detection of graphics objects. However, the language of the claims fails to clearly point out the specific subject matter that applicants are claiming to "model" or clearly define the "interactions" between these models. (see: 101 and 112(1) rejections above)

Dependent claims inherit the deficiency of the claims from which they depend.

While the specification for the claimed invention has been found to be deficient in providing proper enablement for the claims as noted above under 35 USC 101 and 112(1) rejections, in the interest of compact prosecution the examiner has made prior art rejections based on the limited scope of information provided in the specification and a good faith attempt at interpreting the limitations of the claims.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 1-4 and 13-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Adaptive Sampling of Implicit Surfaces for Interactive Modeling and Animation", M. Desbrun et al, iMAFIS Institut Polytechnique de Gernoble, February 2001 in view of U.S. Patent 5,579,455 issued to Green et al.

Independent claim 1 is drawn to modeling interactions between models by:

- generating a 1st ADF with spatial hierarchy for 1st model
- generating a 2nd ADF with spatial hierarchy for 2nd model
- determining overlap region for time step, using 1st & 2nd spatial hierarchies of 1st & 2nd ADF
- when overlap region non-empty generating 3rd ADF from 1st & 2nd ADF's using 1st interaction procedure & properties and generating 4th ADF from 1st & 2nd ADF's using 2nd interaction procedure & properties to model interactions between 1st & 2nd models

Regarding independent claim 1: Desbrun discloses an adaptive distance function algorithm (Section 2, paragraphs 4-10) used to determine proximity between two solids (models, i.e. interaction) used in detecting collision (Section 5, paragraphs 3-5) between graphics objects. Specifically, Desbrun discloses the claimed elements of generating multiple (1st, 2nd, etc.) flexible (i.e. adaptive) distance functions (Section 2, page 4, paragraphs 4-6, Section 5, page 10 last paragraph) based on a region (Figure 1) for a time step (page 5, paragraph 2). Desbrun also discloses the elements of bounding box

regions (Figures 1 & 8) and detecting overlapping elements (page 9, last paragraph, Figures 1 & 8). Obviously, the non-empty regions represent regions of non-collision and hence would have been used by necessity for triggering the generation of the 3rd and 4th ADF's from the subsequent model interactions. Desbrun further discloses interactive modeling (abstract, introduction) which includes a procedural function (page 8, last paragraph) that considers the properties of neighboring models (page 2, last paragraph).

Desbrun does not explicitly disclose models represented in a spatial hierarchy.

Green discloses representing models of graphics objects in a spatial hierarchy. (Abstract, Summary, CL9-L61-CL10-L7, CL22-L8-23, Figs. 3-5) The examiner notes that the technique of storing graphics objects in a spatial hierarchy is very well known and commonly used in the art. (also see: Martin Fig. 4b, for example)

The examiner has interpreted these processes to be functionally equivalent to the interaction procedure of the claimed invention.

It would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to modify the teachings of Desbrun relating to an adaptive distance function algorithm used to determine proximity between two solids in detecting collisions, with the teachings of Green relating to representing models of graphics objects in a spatial hierarchy, to realize the claimed invention. An obvious motivation exists since this area of technology is highly competitive with many techniques for modeling the interactions between soft bodies and collision detection available in the market place (see T. Li, Abstract, for example) Accordingly, a skilled artisan having

access to the teachings of Desbrun and Green would have become aware of what capabilities had already been developed in the market place and, hence, would have knowingly modified the teachings of Desbrun with the teachings of Green in order to reduce development time and cost.

Per dependent claims 2-4, 13-16: These claims are drawn to limitations relating to identity procedures, non-empty overlap region detection, model proximity, and distance values. As noted above, Desbrun discloses generating multiple (1st, 2nd, etc.) flexible (i.e. adaptive) distance functions (Section 2, page 4, paragraphs 4-6, Section 5, page 10 last paragraph) based on a region (Figure 1) for a time step (page 5, paragraph 2). Desbrun also discloses the elements of bounding box regions (Figures 1 & 8) and detecting overlapping elements (page 9, last paragraph, Figures 1 & 8). Obviously, the non-empty regions represent regions of non-collision and hence would have been used by necessity for triggering the generation of the 3rd and 4th ADF's from the subsequent model interactions. Desbrun further discloses interactive modeling (abstract, introduction) which includes a procedural function (page 8, last paragraph) that considers the properties (identity) of neighboring (proximity) models (page 2, last paragraph).

Per claims 17 and 18: Claim 17 merely includes a broader subset of the same limitations recited in 1 and it therefore rejected using the same reasoning as previously cited above. Similarly, claim 18 recites limitations relating to comparing distance values to determine the overlap and is also rejected using the same reasoning as noted above.

7. Dependent claims 5-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Adaptive Sampling of Implicit Surfaces for Interactive Modeling and Animation", M. Desbrun et al, iMAFIS Institut Polytechnique de Gernoble, February 2001 in view of U.S. Patent 5,579,455 issued to Green et al and in further view of U.S. Patent 6,704,694 issued to Basdogan et al.

Regarding dependent claims 5-12: As previously cited above, the limitations of independent claim 1 is rendered obvious in view of the teachings of Desbru and Green relating to adaptive distance function algorithm used to determine proximity between two solids in detecting collisions and representing models of graphics objects in a spatial hierarchy. (see rejection of independent claim 1 above). Dependent claims 4-12 include limitations relating to determining impact forces between graphic objects (models) and force vectors acting on the distance field. Basdogan discloses techniques for determining the impact forces and collision penetration between graphic objects (CL24-L15-CL25-L23, Figs. 7-15) and calculating the related penetration force vectors (CI16-L22-63, CL17-L15-67). A skilled artisan would therefore have knowingly further modified the teachings of Desbru and Green to include the teachings of Basdogan to realize the claimed limitations of dependent claims 5-12 using the same reasoning as previously noted above.

Conclusion

8. *The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Careful consideration should be given prior to applicant's response to this Office Action.*

U.S. Patent 6,714,201 issued to Grinstein et al teaches collision detection between graphic object.

U.S. Patent 6,684,255 issued to Martin teaches hierarchical representation of graphic object.

"Incremental 3D Collision Detection with Hierarchical Data Structures", T.Y. Li, VRST 98', ACM 1-58113-091-8/98/0011, 1998 teaches collision detection between graphic object and hierarchical representation of graphic objects.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fred Ferris whose telephone number is 703-305-9670 and whose normal working hours are 8:30am to 5:00pm Monday to Friday. Any inquiry of a general nature relating to the status of this application should be directed to the group receptionist whose telephone number is 703-305-3900. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jean Homere can be reached at 703- 308-6647.

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